

# WOODRUFF (C.E.)

## The U. S. Army Ration and Military Food.

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Read in the Section of Physiology and Dietetics at the Forty-third Annual Meeting of the American Medical Association, held at Detroit, Mich., June, 1892.

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BY  
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ASSISTANT SURGEON, U. S. ARMY.

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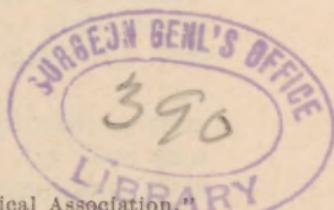
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## THE U. S. ARMY RATION AND MILITARY FOOD.

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Col. Jos. R. Smith, Surgeon U. S. Army, read before the Ninth International Medical Congress, a paper on "The best Ration for the Soldier," in which he very carefully analyzed the ration then existing, compared it with the rations of foreign armies and the dietaries of various laborers, and discussed various other points. To go into this matter again would be threshing out old straw, and the present paper therefore is confined to a description and discussion of the present ration which has been somewhat modified in form and considerably modified as to its management since the time at which the former paper was written.

An army is a collection of disciplined, active, healthy men in the prime of life, to be used as a fighting force in the service of the nation, and it is the object of military administration to so govern and train these men that they shall not fail when fighters are needed. Everything is to be done which can reasonably be expected to increase their efficiency, and it is an actual fact that nearly every military law and regulation has for its ultimate effect the increased efficiency of the individual soldier as a fighter. Unless the man is kept in health, he is useless, and for this reason all subjects which relate to

his health are given much thought. Clothing, food, shelter and exercise are the principal subjects for consideration for if any of them are improper, there is sure to be a loss of efficiency, but it is probable that deficiencies of food or improper food will cause damage or disaster more quickly than anything else. For instance, most of the diseases of the war of 1812 were due to defective food, and in ninety per cent. of the cases the flour was at fault. In the war of the rebellion similar reports were often received, and the tales of actual hunger that all veterans recount, are too numerous by far. It is evident, therefore, that the ration should be the subject of most careful thought, and all reasonable means be tried to adjust it to the exigencies of military life.

A "ration" is the technical term for the sum total of the daily allowances of food issued to the soldier in accordance with law. Its present constituents are given in full in tabular form below.

The candles and soap are considered a part of a ration, though not food.

#### MANAGEMENT OF RATION.

It must not be thought that the soldier is restricted to the actual articles that are mentioned in the table, for by a fairly efficient system, the company commander is permitted to make outside purchases of food. If there is any excess of food uncooked which will not be used by the company, he sells back to the commissary the excess, technically called the "savings," and with the proceeds buys what he thinks proper. These savings are a very important matter, and amount in the aggregate to a fair sum per company, although per man they may average but from 1 to 4 cents per day. This fund is still further augmented by the receipts from the Post Exchange; this institution is a general store for the sale to soldiers of small articles he may need, such as stationery,

TABLE I.—U. S. ARMY RATION.

Component.	One Article of Each List.	
Meat . . . .	{ 12 oz. pork . . . . . 12 oz. bacon . . . . . 22 oz. salt beef . . . . . 20 oz. fresh beef . . . . . 20 oz. mutton . . . . . 14 oz. dried fish . . . . . 18 oz. pickled fish . . . . . 18 oz. fresh fish . . . . .	In 10 days it is usual to give 7 days' of fresh beef, 2 of bacon and 1 of salt pork. The other articles are very seldom issued.
Bread . . . .	{ 18 oz. flour . . . . . 18 oz. soft bread . . . . . 16 oz. hard bread . . . . . 20 oz. corn meal . . . . .	Soft bread is the invariable issue in garrison.
Dried Vegetables . . . .	{ 2 2-5 oz. beans or peas. 1 3-5 oz. rice or hominy.	
Fresh Vegetables . . . .	{ 1 lb. potatoes or 9-10 potatoes and 1-10 onions or 8-10 potatoes and 2-10 onions or 7-10 potatoes and 3-10 canned tomatoes 7-10 potatoes and 3-10 vegetables, such as cabbage, beets, carrots, turnips, squash, etc.	
Coffee . . . .	{ 1 3-5 oz. green coffee. 1 7-25 oz. roasted coffee. 8-25 oz. tea.	
Sugar . . . .	{ 2 2-5 oz. sugar. 16-25 gill molasses or syrup.	
Condiments and additional articles . . . .	{ 8-25 gill vinegar. 16-25 oz. salt. 1-25 oz. pepper. 6-25 oz. candles. [In the field.] 16-25 oz. soap.	

tobacco, lunches, beer, etc., the prices being a slight increase over the cost, and the net profits being turned into the company funds—in other words, a coöperative retail store which makes each soldier a silent partner, though not subject to any losses.

During the first three months of 1892, the average daily receipts and expenditures per man at Fort Assinniboine, Montana, were as follows:

From ration . . . . .	2.72 cents.
From exchange . . . . .	2.58 cents.
From other sources . . . . .	.34 cents.
Total receipts . . . . .	5.64 cents.
Expenditures for extra food . . . . .	4.11 cents.

It will be noticed that the profits from the Post Exchange enabled the daily average expenditures for food to exceed the savings from the ration by 1.39 cents per man. These figures are the averages of nine companies and troops, each having about fifty men.

It is forbidden company commanders to use the savings from the ration except for the benefit of the soldier's table fare, so that there shall be no cheese-paring of the ration in order to save money for other purposes. Very recently part of the savings of the ration was turned into post, band, regimental funds, and what not, and the money used for objects from which the soldier derived no food benefit whatever. It is a curious thing that when in 1864 it was discovered that the soldier could not eat all of his ration, which had been increased in 1861, and that the savings went into post and regimental funds, it apparently did not occur to anyone to abolish these funds, but instead it was deemed wise to reduce the ration to what it had been previous to 1861, notwithstanding the fact that the soldier was often underfed. It was over 25 years before this setback was remedied. At present then, if, owing to climate or other causes, the soldier does not want all of the food to which he is entitled, the money savings must either accumulate in large amounts or be used for the purchase of those little extras, which, added to the bare needs of existence, make life much more worth living. In addition it must be said that large company funds are, as a rule, frowned upon, and, other things being equal, the officer who allows the money to accumulate instead of spending it judiciously for the benefit of his men is not considered to be doing the best. As a general rule it may be safe to say that when a company is so situated as to be liable to be called suddenly into the field, its commander considers it wise to accumulate and keep on hand a certain fund of

from \$200 to \$500 for the purchase of extras in the field whenever practicable, for to be compelled to subsist on the plain ration is looked upon as a misfortune. To keep on hand a fund of one to two thousand dollars is not considered wise management.

In drawing beef at the larger posts, the contractor usually supplies a fore quarter and a hind quarter alternately. At those posts on the frontier where forage is very scarce, the beef is necessarily somewhat tougher than it would be if the cattle could be properly fed before killing. The allowance ( $1\frac{1}{2}$  pounds) is gross weight, the actual amount of meat is much less.

It rests with the Department Commander usually as to how much of each kind of article the soldier shall have when the law allows a choice. It is perhaps usual to order that in ten days there shall be seven issues of beef, two of bacon and one of pork, but if the soldier can with the help of outside purchases, manage to subsist for ten days on the beef allowed for seven days, he saves the money value of one day's pork ration and two of bacon. It might be added that "savings" of fresh beef and fresh vegetables are not permitted, the company being compelled to draw all their allowance, though this regulation does not forbid them to sell privately any they have drawn and which will not be used, but become spoiled by decay.

The management of the flour is taken out of the hands of the company commanders entirely and all flour turned into the post bakery, where all the bread used by the men is baked. The ration of flour is 18 oz., and the soldier is entitled to either that or 18 oz. soft bread, but as that amount of bread can be made from about 10 to 14 oz. flour, there is a large saving of flour, which is sold and after deducting expenses of the bakery, the surplus is returned to the company. Flour needed in the companies for

puddings, griddle cakes, and the like, must be purchased from the company fund. There is usually a good baker among the soldiers at each post or several men who have an aptitude for that trade and who easily learn. These men are detailed for the bakery work and receive extra pay. With but rare exceptions the bread supplied to the soldier is excellent.

By means of the above system of management, a company fund is kept from which the extra diet on holidays can be purchased when there is a convenient market, as for instance turkey on Thanksgiving and Christmas, eggs on Easter and so on. At all other times the fund is constantly drawn upon for the purchase of extras. This fund is considered of the highest importance, and new restrictions are being constantly thrown around it to prevent savings from the ration being diverted to other purposes than for the increased efficiency of the soldier's table. The existence of a good fund for the purchase of extras, has always been taken for granted. An army cook book is issued to troops, and it is full of useful and excellent recipes, but 75 per cent. of them call for articles not supplied in the ration, such as butter, lard, eggs, flavoring and seasoning, and the unfortunate company that is minus a company fund can find no use whatever for over half of these recipes.

The ration is designed for healthy men, and admits of no flexibility to suit the sick. For the latter who might die if forced to subsist on the harsh components of the ration, another arrangement is made. The ration of the sick, or its money value, is given to the surgeon who buys the extra diet that is needed, which purchases are further increased by such articles as beef extracts, condensed milk, etc., supplied by the Medical Department for the use of the sick only.

## SELECTION OF RATION.

An army must often be fed at a great distance from the market, and it is therefore evident that the chief objects in view in the selection of the soldier's food must be facility of transportation and ease of preservation in all climates. Articles that are bulky or easily damaged by rough handling, and those that are not easily preserved from decay are at once ruled out. It need scarcely be mentioned that the articles must be produced in abundance throughout the country, neither imported nor the particular preparations of a few manufacturers. Couple with this, the fact that the articles must be so inexpensive as to refute any charges of extravagance and it will be readily understood that with a few exceptions, the ration contains about all the articles that it is possible to put in it at present without calling on foods that are preserved, canned or otherwise specially prepared. In regard to charges of extravagance it may be remarked in passing, that as the present ration usually costs less than 15 cents it is rather far fetched to talk of extravagance. There are few healthy laborers in respectable standing in civil life who subsist on less than one dollar a week.

For these reasons, the soldier's ration has always been simple and dry. Indeed, until quite recently, there has been but little change in the ration for 75 years. For instance, omitting details, during the revolution, the soldier's food was essentially: 1 pound beef, 1 pound bread, 1 pint milk, 1 quart beer, and a taste of molasses and dried vegetables, though practically he received but a small fraction of his allowance. In 1785, after the war, it was even simpler, 1 pound beef, 1 pound bread, and 1 gill of rum. The beef was increased to 1 $\frac{1}{4}$  pound in 1798, and the bread or flour to 18 oz. at the same time, at which they have since remained except for three years dur-

ing the rebellion when the bread or flour was increased by four ounces. At this time also (1861-1864) 1 pound potatoes was issued three times a week. From time to time other changes and slight additions were made; in 1818 some dried vegetables (peas, etc.,) were added; in 1832 a small amount of coffee and sugar was issued in lieu of spirits, and there have been numerous changes in salt, pepper and vinegar. The coffee and sugar have remained unaltered for 32 years. At the present time the ration is more liberal than it has ever been before.

Human beings can by degrees become accustomed to any diet, even though it be outrageous; they can subsist chiefly on fruits in the tropics or chiefly on fats in the arctic regions, but any rapid change of diet is disastrous. Now, as the militia when mustered into the service of the United States must subsist on the army ration, it is a cardinal principle that the food supplied must closely approximate that to which they are accustomed. As regards the present ration this is approximately so, but it has not always been the case. The Secretary of War (Mr. Calhoun) in 1818 reported to Congress that the mortality during the wars of the revolution and 1812 from the change of a plentiful mode of living to that of the camp, "was probably greater than from the sword." As Americans live more liberally than Europeans in similar walks of life, we have at once an incontrovertible reason why the U. S. ration should be more liberal than that of any European army. The American laborer has meat every day, while the European laborer may have it but once a week, and the American soldier must and does have meat three times a day.

There is another point to which a mere reference is necessary. In cold climates no article can be used in the field in winter, that would be spoiled by freezing, or by alternate freezing and thawing. This

blocks out a few articles put up in cans in fluid preservative, potatoes and all fresh vegetables, and fruits and various other articles.

Until quite recently (within 50 years), it was presumed that if the ration kept the soldier alive it was sufficient. The idea that it should keep him in health is modern, and logically follows both from increased knowledge of the etiology of faulty food in the production of disease, and from a contemplation of disastrous epidemics on land and sea, following upon a long continued improper food. The smallest amount of food that will keep a man alive has been approximately known for centuries, and though modern experiments make our knowledge vastly more detailed, accurate, and scientific, they have added little to the knowledge that one pound of bread and  $1\frac{1}{4}$  meat daily will subsist a man for quite a long period. When we come to discuss the amount and kind of food necessary to keep him in health we are on debatable ground. Our knowledge on this subject is not yet complete enough, we have only theories and opinions. A man may appear to be healthy, but it is not quite certain that he may, on the one hand be taking too much of one variety of food, generating a tendency to plethora or lithæmia, or on the other hand living in a constant tendency to anaemia or serobutus, with all the liability to contract other diseases from lessened general vitality and resisting powers. We all know men whose usual daily food is even more simple than the ration, but we know also that there are times, as during occasional visits from home, when they eat other things that perhaps restore the balance. Patients have often been restored to health by a change of diet made necessary by a recommended change of scene.

#### VARIETY.

The soldier is occasionally so situated for pro-

longed periods that he leads an essentially sedentary life, and the total amount of food energy needed is far less than what is supplied. It is in such circumstances that there must be more variety than the ration affords. When he works hard he can subsist on an unvaried diet and feel well, but if he lives in enforced idleness, the poorer menu seen in table 12 would soon cause satiety. Practically and usually, variety is secured by purchase or gardens, but occasionally it cannot be so secured. The gardens at military posts are considered of great value and fostered with as much care as possible. Seeds and implements are furnished to a certain extent, suitable ground reserved for the purpose, and men detailed for the work and excused from other duties. There is a feeling that the soldier should not be compelled to raise his own vegetables. The company is liable, in some places, to be called into the field and the garden neglected to its ruin, and the daily military routine with its exactions and privations is liable to discourage in the soldier such continuous labor as is the lot of farmers. Practically it is found that there are several men in each company who have been raised as farmers, and who are anxious to do the work.

The diet can be greatly improved by the addition of soups, providing the cook is efficient. Bones are too often thrown away, and though they cannot supply much nutriment, as explained on page 659, yet soups may be made the vehicle for the nutriment of rice, beans, tomatoes and other vegetables. Those companies blessed with good, economical, and energetic cooks usually have soups quite frequently, and the extra comfort thereby gained more than compensates for the trouble.

In regard to the variety of the ration, the thought is now being evolved that it is no more necessary to have a ration that will keep in all climates, than it

is to have a uniform that can be worn in all climates, whether 50 below zero, or 130 above. As the food can be purchased within the climatic district in which it is used, the ration in the extreme north can be of such a nature that it might spoil in the extreme south or *vice versa*. If such a radical idea ever becomes practicable it will greatly facilitate the process of making the ration flexible. A few years ago it was thought that the soldier of the southern summer must eat the same kind of fat pork, etc., that was used in the northern winter, but at present it is recognized that there must be a distinction, and as time goes on there is a greater and greater tendency shown to adapt the food to the place and circumstances. The addition to the ration of fresh vegetables in 1890, has been one of the greatest advances made since 1818, when dried vegetables were added in lieu of some of the old issues, and various other substitutions permitted. The occasional issue of dried or fresh fruits of the cheaper and more easily preserved varieties would be a boon highly appreciated by the troops in the hot districts of the south.

If two ships were to start from New York, each to be absent several years, one in the Arctic regions and the other in the tropics, no one would even dream of provisioning them alike. Yet if two armies were similarly to start from New York for long periods, one to the extreme north, and the other to the hottest parts of the south, the law presumes that both shall carry essentially the *same* rations. We have not yet reached the point where it is decidedly recognized that the variety in the ration must be great enough to permit of sufficient flexibility to suit extremes of climate.

As all armies in the world have been fed on the same general principles, there is scarcely any doubt that the dryness and the sameness of the food is a great factor in the production of the tendency to

drunkenness, proverbial among soldiers and sailors. Drunkenness can never be eradicated from an army. The class of men from whom the soldiers are recruited are not tee-totalers, but it is safe to say that there has been a phenomenal decrease in the amount of drunkenness in recent years, and it may be justifiable to predict a still further decrease as the food becomes more varied. The writer once canvassed the men at a small post, Fort Gaston, California, and found that there was a large per cent. of total abstainers, and at that time, he was certain that it was a larger percentage than among mechanics and laborers in civil life; but the post was most favorably situated, was blessed with an enormous garden for vegetables, there was a profusion of fruit in season, and game could be obtained throughout the year. As elsewhere mentioned, the sameness of diet of German soldiers during the Franco-Prussian war when Ebswurst was used, was compensated for by the large stores of wine found in the vicinity of Paris, and by the occasional issue of brandy, a still further proof of the tendency to drink alcoholic beverages when food is scanty and unvaried.

It is probably true that at posts in cold climates in winter when there is much idleness, and the diet is not varied, the soldiers suffer more from chronic constipation than an equal number of healthy civilians. It would be impossible to substantiate such a statement because reference is made to those slight cases which never appear on the sick report, but who try to treat themselves with patent medicines. If it is true generally, it is due in part at least to the sameness of diet and the absence of fresh fruits and vegetables. Since the addition of potatoes all the year, and of fresh vegetables in summer, there may have been an improvement, but how much, if any, is not known.

The enormous number of cases of rheumatism

occurring during the rebellion and since the rebellion in veterans may not be entirely due to the exposures, as popularly supposed. These men were hardened to exposure and should not have had more rheumatism than hunters, trappers, and the aboriginal Indians. The limited, often insufficient, ration and the absence of fresh articles may have been one of the factors at work. Indeed, new facts are being continually brought forward, showing new relations between a disease and the habitual diet of a patient. Diet also in its relation to diseased states, is becoming an all important item of therapeutics. It may be justifiable therefore to express a doubt as to whether in the long run, the bare, unadorned unvaried ration as issued, will tend towards the production of perfect health and the greatest efficiency, if eaten to the exclusion of everything else.

#### COOKING.

Every soldier is supposed to be able to cook his own ration. He can no more do it than can every mechanic go into his own kitchen and prepare his own meals. Cooking is a fine art and cannot be learned, though some of its technique can be taught. There must be aptitude. Officers of experience state that unless the soldier shows much aptitude as a cook it is useless to try to teach him. In every company there is usually one man who is fairly expert, and he is detailed as company cook and excused from other duties. It is almost needless to remark that he is a most important adjunct of the military organization. It has been said that the cook is the real manager of a company, and as he is good or bad, so is the company good or bad. The writer once served at a post where one company, blessed with a born cook among its soldiers, lived in a state as nearly approaching luxury as could be desired, while another organization with exactly the same ration, but having a

thorough-bred idiot for a cook, lived on miserable fare and were discontented and thoroughly unhappy. Indeed, if the soldier's ration were as good and varied as the country affords, it could be ruined by some of the men who preside over the army cooking. This matter has become so important, that it is now recommended on all sides that a special cook be enlisted for each organization as is the case in the navy. It may be said that the soldier is occasionally absent from his company and in that case should be able to cook his own ration, but in that case, he cannot carry utensils, and he is furnished with a special cooked ration to be described, and in addition the uncooked ration is supplied to the company only when cooking is practicable.

Though the frying pan is a recognized evil in civil life, wastes food by making much of it indigestible, causes dyspepsia and untold evils, and is a general all around nuisance to physicians, yet it is well nigh impossible to do without it in the army, particularly in the field. A trapper or frontiersman will cling to his frying pan as his dearest friend, and the soldier's fire indeed admits of only the simplest kind of cooking—frying and boiling. The evil in the field is not so great as would be supposed, for it is well known that outdoor life certainly increases the digestive powers to a most wonderful extent. The writer once knew an officer who was a confirmed, pessimistic dyspeptic, whose diet had to be almost as carefully selected as a child's, and whose illness was probably due to lack of exercise, for when he took the field and was compelled to do fatiguing work, he ate large quantities of fried food, dripping in grease, and not only was he comfortable, but he grew fat and was actually cheerful. In the garrison diet lists of tables 12 and 13 it will be noticed that there are very few fried articles.

At certain large posts an innovation in the way of

a general mess is now in practical operation, the cooking is all done in a central kitchen and the men all partake of the same fare. This change is being tried in the interest of economy and efficiency, it being supposed that there is less waste and better cooking. It is possibly too soon to give a definite opinion as to the value of the general mess in the army. For field service, particularly in the western country, where a company is so often on duty detached from its regiment, the company mess will probably prevail, because the utensils must be kept on hand, and the system must be constantly practised in order to be efficient, and in addition it is not practicable with camp fires, and portable ovens to cook for very large numbers in temporary camps or on the march.

Very closely connected with cooking is the proper serving of food. When soldiers are in the field, each one must look after his own affairs and take care of his own tin plate and cup, iron knife, fork and spoon, and nothing breakable is carried. Everyone who has been camping knows how difficult it is to take along many appliances, and how makeshifts must be used when serving food. In garrison there has been a decided change in recent years. Each company formerly bought its own dining outfit which was very elaborate in some cases, but quite poor in others; at present all are supplied by the Quartermaster's Department with very fair utensils, plain white dishes, silverplated knives, forks, and spoons, etc. These utensils make the table look very well, and as scrupulous cleanliness is invariably the rule, the appearance of the soldier's dining room in general is conducive to good appetites. This great attention given to the dining room and serving of food has a very decided elevating effect upon men. In civil life unusual brutality in men is not infrequently accompanied by the grossest table manners, and each is cause and

each is effect, reacting upon one another. Compel a man to observe decency at table, supplying him with a neat, clean and orderly outfit, and the elevating effect is sure to come. Military men of the last century believed that to keep a soldier up to a proper discipline he should be clothed roughly, given the simplest kind of overcrowded barracks, and fed like a hog, every modern improvement being considered enervating. Could any of these dead officers see the dining rooms of some of our soldier barracks, they would surely think that the service was going to the dogs. It has been elsewhere remarked that when hardships slowly reduce vitality, the man is made less able to exist under more privation in the field. When there are no luxuries and everything has to be plain in order to be durable and serviceable, it is utter nonsense to talk of the enervating effects of luxuries. The present policy of improving the soldier's table service certainly improves the ration on principals known to every physiologist. The companies where the table is still bad are becoming the exceptions to the rule.

#### GARRISON RATION.

In calculating the food value of the soldier's garrison ration it has usually been the custom to take the articles mentioned in the regulations. This ignores the food from outside purchases, often considerable, and does not show what the soldier actually eats. The writer has been at considerable pains to find out exactly how much the soldiers ate at Fort Assiniboine, Montana, during the ten days from March 11 to 20, 1892. There were supplied to each company, blank forms on which were entered the itemized amounts of food on hand at the beginning, received during the ten days, and on hand at the end, from which was calculated the amount eaten, due allowance having been made for waste which was also

carefully measured. The results of these experiments are detailed in tabular form below. These figures are accurate within moderately small limits

TABLE II.—PERCENTAGE COMPOSITION OF EDIBLE PORTIONS  
GARRISON RATION.

	Water.	Protein.	Fats.	Carbo-Hydrate.	Salts.	Energy, calories per lb.	Authority.
Bacon, fat . . . . .	20.0	8.00	69.5	. . . . .	2.5	3080	Estimated fr. L. tables
Beans . . . . .	12.6	23.10	2.0	59.2	3.1	1615	Atwater.
Pork, salt and fat. . . . .	12.1	.90	82.8	. . . . .	4.2	3510	"
Sugar, gr . . . . .	2.0	. . . . .	. . . . .	97.8	.2	1820	"
Sugar, brown issue . . . . .	3.0	. . . . .	. . . . .	96.5	.5	1795	Estimated fr'm L. & A.
Flour . . . . .	12.5	11.00	1.0	74.9	.5	1644	Atwater.
Beef . . . . .	55.0	17.10	27.0	. . . . .	.9	1460	"
Potatoes . . . . .	78.9	2.10	.1	17.9	1.0	375	"
Onions . . . . .	87.6	1.4	.3	10.1	.6	225	"
Oatmeal . . . . .	7.6	15.10	7.1	68.2	2.0	1850	"
Cornmeal . . . . .	15.0	9.20	3.8	70.6	1.4	1645	"
Canned apples . . . . .	83.2	.20	.4	15.9	.3	315	" (fresh apples)
Dried apples . . . . .	25.0	.90	1.8	71.5	1.4	1418	Estimated from A.
Tapioca or corn starch . . . . .	2.0	. . . . .	. . . . .	97.8	.2	1820	Atwater.
Butter . . . . .	10.5	1.00	85.0	.5	3.0	3615	"
Syrup . . . . .	43.7	. . . . .	. . . . .	55.0	2.3	1023	Estimated from A.
Lard . . . . .	12.0	.60	83.4	. . . . .	4.0	3370	"
Rice . . . . .	12.4	7.4	.4	79.4	.4	1630	Atwater.
Canned corn . . . . .	84.3	2.80	1.1	13.2	.6	345	" (green corn).
" tomatoes . . . . .	96.0	.80	.4	2.5	.3	80	" (fresh tomatoes).
Macaroni and vermicelli . . . . .	13.1	9.00	.3	76.8	.8	1106	Koenig.
Milk, fresh . . . . .	14.1	.843	.802	1.069	.164	418	Lethéby — ounces per pint of milk.
" condensed . . . . .	25.0	17.00	11.0	44.00	.9	1595	Pavy.
Pens . . . . .	12.3	26.70	1.7	56.40	2.9	1565	Atwater.
Raisins . . . . .	40.0	.40	. . . . .	24.00	.6	440	Estimated from L.
Cheese . . . . .	35.0	33.00	22.0	5.00	5.0	1600	Atwater (average).
Prunes . . . . .	30.0	2.50	. . . . .	12.0	.6	140	Approx. estimate from Fresenius.
Cabbage . . . . .	92.0	2.10	.6	5.5	1.1	155	Atwater.
Ham . . . . .	41.5	16.7	.91	. . . . .	2.7	1960	"
Apricots, canned . . . . .	50.0	2.00	. . . . .	30.0	.6	460	Estimated from Fresenius.
Barley . . . . .	. . . . .	13.00	2.7	76.0	3.0	1800	Lethéby.
Chocolate . . . . .	12.0	20.00	50.0	10.0	4.0	2650	Pavy.
Sausage . . . . .	41.2	13.80	42.8	. . . . .	2.2	2065	Atwater.
Oysters . . . . .	87.1	6.00	1.2	3.7	2.0	230	"
Salmon, canned . . . . .	63.6	21.60	13.4	. . . . .	1.4	965	" (fresh salmon)
Crabs . . . . .	. . . . .	15.0	1.0	. . . . .	. . .	526	Pavy.
Crackers . . . . .	. . . . .	10.3	9.4	70.5	. . .	1900	Estimated from A.

L.—Lethéby. A.—Atwater.

for the weighings were carefully done under the direction of the company commanders, and wherever it has been possible to verify the results by other determinations they agree. The results are of considerable interest because it is the first time this work has been done since the ration was increased by the addition of vegetables, since it has been forbidden company commanders to use the saving of the ration for other purposes than for the table, and since the fund for extras has been so largely increased by the profits of the Post Exchange. When it is considered that at this isolated post, outside purchases are limited, that the Exchange is scarcely yet in full swing and that the garden-truck had been already consumed, it can be readily imagined that under more favorable conditions the variety of food might be far better and that the amounts of alimentary principles somewhat different, perhaps larger.

In table 2 there is stated merely for reference the percentage composition of the various articles consumed. Some of these values assumed for the articles are probably different from those used in making the experiments whose results are taken as a guide. In all cases there was an authoritative estimate on which to base the assumed values. As the percentages are averages, the results obtained by using them cannot be considered as precise or accurate but were approximations whose probable errors may be large.

#### REMARKS ON TABLE III.

The amounts of beef were calculated as follows,— After deducting  $993\frac{1}{4}$  pounds bone, and  $37\frac{1}{2}$  pounds other wastes, the rest was considered as edible, and its composition calculated according to Atwater's percentages, but there was a further waste of about 100 pounds fats, and that amount was subsequently

TABLE III.—UNCOOKED FOOD OF GARRISON RATION FOR 10 DAYS. WEIGHTS IN POUNDS.  
DAILY AVERAGE, 440.4 MEN.

	Gross Weight.	Waste.	Net Weight.	Water.	Protein.	Fats.	Carbo-hydrates.	Salts.	Calories.
Bacon . . . . .	270 $\frac{3}{4}$	3 $\frac{3}{4}$	270	54.00	21.60	187.65		6.75	834,600
Beans . . . . .	428 $\frac{1}{2}$		428 $\frac{1}{2}$	54.05	99.10	8.57	253.80	13.29	691,228
Pork . . . . .	343 $\frac{3}{4}$	31	312 $\frac{1}{4}$	37.85	2.82	259.00			13.14, 1,097,753
Sugar, brown . . . . .	731		731	21.93			705.42	3.66	1,312,081
Flour . . . . .	4379	126 $\frac{1}{2}$	4252 $\frac{1}{2}$	531.56	467.78	46.78	3185.12	21.26	6,991,110
Beef . . . . .	5025	1131	3894	2196.70	682.97	978.38		35.95	5,409,392
Potatoes . . . . .	5116	1386	3730	2943.00	78.33	3.73	667.67	1,398,750	
Onions . . . . .	700	150	550	481.80	7.70	1.65	55.55	3.30	123,750
Oatmeal . . . . .	44		44	3.34	6.65	3.13	30.01	.88	81,400
Cornmeal . . . . .	85		85	12.75	7.82	3.23	60.01	1.19	139,825
Apples, canned . . . . .	10		10	8.32	.02	.04	1.59	.03	3,150
Apples, dried . . . . .	187		183	46.85	1.65	3.30	180.85	2.57	259,494
Tapioca [26] and Corn Starch [13] . . . . .	39		39	.78			38.14	.08	70,980
Butter . . . . .	58		58	6.09	.58	49.30	.29	1.74	209,670
Syrup . . . . .	165		165	70.60			90.60	3.80	168,795
Lard . . . . .	107 $\frac{1}{2}$		107 $\frac{1}{2}$	12.90	.65	89.66		4.30	388,775
Rice . . . . .	26		26	3.22	1.92	.14	20.65	.14	42,380
Corn, canned . . . . .	63		63	51.22	1.77	.70	8.32	.38	21,735
Tomatoes, canned . . . . .	332		332	318.72	2.66	1.33	8.30	1.00	26,560
Maccaroni [51] and Vermicelli [1 $\frac{1}{2}$ ] . . . . .	52 $\frac{1}{2}$		52 $\frac{1}{2}$	6.88	4.78	.15	40.32	.42	73,815
Milk, fresh, pounds . . . . .	31		31	25.61	1.58	1.50	2.00	.31	12,552
Milk, condensed, pounds . . . . .	31		31	7.75	5.27	3.41	13.64	.93	49,442
Cheese . . . . .	101 $\frac{1}{2}$	1 $\frac{1}{2}$	10	3.50	3.30	2.20	.50	.50	16,000
Prunes . . . . .	35	20	15	10.00	.75		4.00	.25	3,500
Cabbage and Sauerkraut . . . . .	250	50	200	182.00	4.20	.60	11.00	2.20	31,000
Ham . . . . .	32	4	28	11.63	4.68	11.00		.76	54,880
Apricots . . . . .	20		20	13.50	.40			6.00	9,200
Barley . . . . .	5		5		.65	.14	3.80	.15	9,000
Peas . . . . .	4 $\frac{1}{2}$		4 $\frac{1}{2}$	.55	1.20	.08	2.54	.12	7,043
Raisins . . . . .	14	4	10	6.45	.05		3.50	.08	6,153
Chocolate . . . . .	3		3	.48	.60	1.50	.30	.12	7,950
Totals . . . . .	18598	2908 $\frac{3}{4}$	15689 $\frac{1}{4}$	7120.50	1413.21	1657.17	5343.66	154.82	19,446,960

Pounds.

Grams.

Daily average per man . . . . .

4.22	.66	3.56	733	145	171	550	16	4,416
15 $\frac{1}{2}$ %	85 $\frac{1}{2}$ %							

Counting flour as bread, amount eaten is  
4 lbs. per man. Per cent. of amount  
eaten . . . . .

45	9	11	34	1	
733	145	171	550	34	

Including Table V (salts only), grammes.  
Including estimated amounts in Tables

5	3 $\frac{3}{4}$	4 $\frac{1}{4}$						
		about 2.8 lbs. water free.						

V and VII . . . . .

deducted from the amount of fats and its heat energy taken from the number of calories.

There were 4,546 rations of bread used, amounting to 5,114 $\frac{1}{2}$  pounds of bread, a ration of bread being 18 ounces. From this is deducted 167 $\frac{3}{4}$  pounds of bread wasted, leaving the amount eaten, 4,946 $\frac{1}{2}$  pounds of bread. During the month of March, 10,300 pounds of flour were used in the Post Bakery to make 13,669 pounds of bread, so that the 4,946 $\frac{1}{2}$  pounds of bread eaten represents 3,727 $\frac{1}{2}$  pounds of flour. The bread wasted (167 $\frac{3}{4}$  pounds) contains 126 $\frac{1}{2}$  pounds of flour, so that the flour used was 3,854 pounds. To this is added 525 pounds flour purchased for other purposes, making the total flour used 4,379 pounds, and eaten 4,252 $\frac{1}{2}$  pounds.

The bacon is estimated from the tables of Lethaby, neither of the estimates there given can refer to the fat and smoked variety supplied to the soldier.

Everything below onions was purchased from the company funds and some of those above onions, that is, some beef, flour, potatoes, onions and sugar.

Table 4 needs scarcely any explanation, but attention might be called to a few facts. The bones of

TABLE IV.—PERCENTAGE OF WASTES.

Bacon . . . .	1.40	
Pork . . . .	8.00	Only 9 lbs. were reported, but this was increased to 31 lbs., to include bones, etc.
Bread . . . .	3.30	Crusts and small unavoidable wastes.
Beef . . . .	22.50	19 $\frac{3}{4}$ bone, 2 $\frac{3}{4}$ fat and other wastes.
Potatoes . . . .	27.09	Parings and defective ones.
Onions . . . .	21.04	" " "
Prunes . . . .	33.00	Stones and other wastes.
Cabbage . . . .	45.00	
Ham . . . .	12.00	Estimated.

beef were weighed with great care, and the result 19 $\frac{3}{4}$  per cent. agrees almost exactly with Atwater's tables. The percentage of bone usually given (17) is too small. The law that states that the soldier is to get a ration of 20 ounces of beef has always been

interpreted to mean gross weight, so that he gets but 15½ ounces edible meat, and as physiologists in referring to the army ration, imply that the food is essentially 1 pound bread and 1½ bone free meat, there has always been a misapprehension. In Dr. Dalton's minimum diet of 19 ounces of bread, 16 ounces of beef, and 3½ ounces of fat, the meat is all edible. It is an open question whether there is any justification for considering the law as referring to bone-free beef; an overpowering spirit of generosity would suggest the latter.

In the case of potatoes there is a large waste, 27.09 per cent. which is what might be expected, so that there is really served to the soldier only 11 ounces instead of 16.

Onions have a waste of 21.04 per cent. which is apparently correct.

Bread, beef, potatoes and onions were very carefully determined. There were wastes in the following articles, but so small in amount that they have been ignored: beans, rice, macaroni, hash, dried apples.

Where there are efficient cooks, the kitchen waste contains nothing of any food value to the soldiers, and is thrown away as in civil life. Though it may have a value for fertilizer or for live stock, there is usually no market. It is often the custom for each company to keep hogs, but the surroundings are apt to get in such an unsanitary condition that the practice is usually abandoned on the score of health. The bones might be of value, particularly in this State, for the market value of bone dust is said to be sixty dollars a ton, and taking the local value of bones at thirty dollars, there is a loss of one thousand dollars a year at this post from the bones thrown away.

Table 5 contains a list of articles which were supplied and consumed, but as they contain practically no nutriment, they have been omitted from table 3.

Table 6, giving the amounts used per man with

TABLE V.—ADDITIONAL ARTICLES CONSUMED.

	Daily per man.	Allow- ance.	
338 lbs. green coffee . . . . .	1.23 oz.	1.60 oz. or	
8 lbs. tea . . . . .	.03 oz.	.32 oz.	
20 gall. vinegar . . . . .	.14 gill	.32 gill	
128 lbs. salt . . . . .	.46 oz.	.64 oz.	
10 lbs. pepper . . . . .			{ Allowance is large, to allow of
11 bottles flavoring extracts.			making a saving to be used in
3 lbs. mustard.			making sauerkraut and pickles
24 lbs. baking powd'r			in the fall.
6 lbs. currants.			
5 gall. pickles.			
4 kegs pickled pigs' feet . . . . .			{ Though containing much energy, it is omitted be- cause composition is unknown, and the actual amount per man is very small.

TABLE VI.—CONSUMPTION AND ALLOWANCE PER MAN.

	Daily per man.	Allow- ance.	
4,379 lbs. flour . . . . .	15.91 oz.	18 oz.	Includes purchases.
4,946 $\frac{1}{4}$ lbs. bread . . . . .	17.97 oz.	18 oz.	
343 $\frac{3}{4}$ lbs. pork . . . . .	1.34 oz.	1.2 oz.	
273 $\frac{3}{4}$ lbs. bacon . . . . .	1.00 oz.	2.4 oz.	
5,025 lbs. beef . . . . .	18.30 oz.	18.0 oz.	
5,116 lbs. potatoes . . . . .	18.5 oz.	12.8 oz.	80% of vegetables.
700 lbs. onions . . . . .	2.5 oz.	3.2 oz.	20% of "
428 $\frac{1}{2}$ lbs. beans . . . . .	1.5 oz.	2.4 oz.	
763 lbs. sugar . . . . .	2.7 oz.	2.4 oz.	
64 lbs. butter . . . . .	.2 oz.	....	
137 lbs. lard . . . . .	.5 oz.	....	
15 gall. syrup . . . . .	.4 gill	....	

the allowance of a few articles in table 3 is given merely to supplement the latter table and contains only the items used in the greater amounts.

The following articles were in greater quantities than the ration, the excess being purchase: Beef, potatoes, flour, and sugar. The savings were chiefly on flour (from bakery) and bacon. Almost all of the companies bought beef, potatoes, lard, syrup, and baking powder, and a few bought flour, butter and

bread. The use of butter, lard or syrup bears out the ideas of certain officers that one of these articles should be an article of issue and not of purchase, on the supposition that the company fund should be used to purchase articles of occasional use and not articles of constant use. The expenditures for extra food during these ten days were larger than the average expenditures for the three months of January, February, and March. With rare exceptions the soldier uses more than his allowance of potatoes.

#### FOOD EATEN AT POST EXCHANGE.

Table 7 gives the itemized amounts of food eaten at the Post Exchange lunch counter during the ten

TABLE VII.—AMOUNTS OF FOOD EATEN AT POST EXCHANGE.

	Protein.	Fats.	Carbo-hydrates.	Alcohol.	Calories.
161 lbs. flour . . . . .	17.71	1.77	121.00	.	264,684
6 " butter . . . . .	.06	5.10	.03	.	21,690
55 " ham . . . . .	9.19	21.51	.	.	107,800
6 " sugar, brown . . . . .	.	.	5.80	.	10,770
16 " granulated . . . . .	.	.	15.65	.	29,120
30 " cheese . . . . .	9.90	6.60	1.50	.	48,000
67 " sausage . . . . .	9.25	28.70	.	.	138,355
20 " lard . . . . .	1.20	16.68	.	.	71,400
100 " canned fruit . . . . .	.20	.40	16.00	.	13,500
80 " oysters . . . . .	4.80	1.00	2.96	.	18,400
14 " salmon, canned . . . . .	3.02	1.88	.	.	13,510
14 " shrimps . . . . .	2.10	.15	.	.	7,365
10 " prunes . . . . .	.15	.	4.50	.	4,500
36 " crackers . . . . .	3.71	3.39	25.38	.	68,400
10 " eggs . . . . .	1.50	1.05	.	.	7,210
11 " milk . . . . .	1.87	1.21	4.84	.	17,182
10 " mincemeat . . . . .	.80	1.00	.20	.	60,782
Total, 646 lbs . . . . .	65.46	90.41	197.86	.	902,668
Per man, daily, .15 lbs. Grams . . . . .	7	9	20	.	205
Beer, percentage composition by weight . . . . .	.54	.	4.8	4.15	.
20 oz. daily per man { Ounces . . . . .	.11	.	.960	.83	286
{ Grams . . . . .	3.	.	27	24	286

days. The men who ate this food were, according to the officer in charge, wholly among the 440 men of

the companies, the other soldiers at the Post who board themselves do not patronize this lunch counter. Some of the results are necessarily assumed for no authentic percentage tables of values are probably in existence, but each value was calculated from the tables of value of similar articles in Pavy's work on Foods. It is probable that the aggregate error is not large, as the articles referred to, canned oysters, shrimps, canned fruit, mince meat, etc., are in small amounts and besides do not contain much energy per pound.

In the Post Exchange there were sold during the ten days, 3,744 bottles (quarts) of beer. The officer in charge reports that the 440 men of the companies whose food is being calculated, drank their proportional share, and as there was a daily average of 473 men present, it would give an average of 24 ounces per man. As some men drank while others did not, it is probable that a few of the former occasionally took more than they could assimilate and counting the undigested as waste, 20 ounces per man are therefore assumed as the daily average consumption, and this corresponds with the minimum allowed to a healthy man by Parkes, one to two pints of 20 ounces each. The percentage composition of this beer was furnished by the analyst of the brewing company and the calculated values are stated separately in order that he who does not believe that the small amount of alcohol and carbo-hydrates of beer can serve any useful purpose in the economy towards the production of energy, can omit the beer if he chooses. Alcohol being between fats and carbo-hydrates in heat production, is assumed to have heat value of  $1\frac{1}{2}$  times its weight of carbo-hydrates.

All other alcoholic beverages consumed during the same time are unknown, they cannot even be assumed, and as they add some energy to the sum total, the results given without them can be therefore very

safely taken as below the actual alcohol used per man, rather than above it.

Thus the whole amount of food eaten in ten days by 440 healthy, active men in the prime of life, is known within a very few pounds. All sources of outside supply are absent, they can get food at no other places. There is a trader's store, but on inquiry it is stated that the amount of food purchased (crackers, cakes, candy, etc.) is so small that the daily average amount per man is probably less than a gram of each of the alimentary principles. For these reasons much care has been taken to calculate the proper values, in order to give as great an accuracy to the results obtained as is possible, while at the same time illustrating the actual food of the soldier. A word might be said as to the other conditions. The men during this time were fairly active, having daily drills, and fatigue duty, once a week gymnastics, and large numbers patronizing the gymnasium and other sports during leisure hours. The weather was cold, averaging 24° F., ranging from 64° above zero to 1° below. It must be remembered that the results represent nothing more than stated, and as elsewhere explained there should be no attempt made to give these figures as the proper food values necessary to keep in health an active man in the prime of life and performing moderate labor. That this food appears to keep the men in health, cannot be denied for an instant.

#### THE RATION IN THE FIELD.

When troops are in a permanent camp close to markets, and cooking facilities are improvised, the ration may be essentially the same as that already described in garrison. When at a distance from markets and from the base of supplies, it is not so varied, for purchases are impossible and the food is absolutely limited to that which they have been able

to carry with them in supply wagons. The ideas of different officers vary somewhat as to what are the best and most palatable articles for camping, but the following is the list from which choice is to be made.

TABLE VIII.—RATION IN THE FIELD.

Meat . . . . .	{ 12 oz. fat pork or 12 oz. fat bacon.
Bread . . . . .	{ 18 oz. flour or 16 oz. hard bread.
Vegetables . . . . .	{ 2 2-5 oz. beans or 2 2-5 oz. peas or 1 3-5 oz. rice or 1 3-5 oz. hominy.
Fresh vegetables . . . . .	16 oz. potatoes (if they can be carried).
Coffee . . . . .	{ 1 3-5 oz. green coffee or 1 5-25 oz. roasted coffee or 8-25 oz. tea.
Sugar . . . . .	2 2-5 oz. brown sugar.

If dried vegetables cannot be cooked, the money value thereof may be issued in meat or bread.

This amounts in alimentary principles to the following:

Grams.	{ Maximum . . . . .	Protein.	Carbo-		
			Fats.	hydrates.	Calories.
	{ Minimum . . . . .	106 64	320 240	540 460	5,166 4,722
Average . . . . .		85	280	500	4,944

The detailed figures are not given, as the averages thus shown are sufficient for practical purposes of comparison. The most striking fact about this ration is the deficiency of protein. The fats are not in excess, considering the conditions of service, and the high rate of heat energy is due in great part to the fats of the pork or bacon. These facts are enlarged upon below.

## RATION ON THE MARCH.

When on the march where good camps can be

made every night and transportation facilities are abundant, the ration is the same as for the camp already described, but when the troops are compelled to march every day, certain changes may become necessary. The dried vegetables are in such small amounts that they do not alter the relative proportion of the various constituents, and they are omitted in the following discussion. If the country is well settled, fresh meat and vegetables may be procured by purchases from the company fund, but in the wilderness it is a choice between pork and bacon. For its convenience in frying, bacon is usually carried. Pork is not so convenient but by the following method is said to be preferable. Capt. W. F. Spurgin, 21st Infantry, a recognized authority on the ration, writes that during the Nez Perces campaign in 1877, when the troops were following the Indians hundreds of miles, he would on making camp, start a fire and have the pork thoroughly boiled; this was put away to cool and be used during the next day. At the same time some soup stock, which was carried along, was quickly made into a good soup for dinner. Whenever it was convenient and bones could be secured, enough soup stock was made by prolonged boiling to last several days. Beans were also prepared by cooking them over night.

The hard bread (16 ounces) and flour (18 ounces) do not differ much in their ultimate composition and it is immaterial which shall be carried. When the camps are convenient enough, some form of biscuits can be made with the yeast powder supplied, and in such circumstances flour is taken.

In regard to the nutrient contained, it is material whether pork or bacon be used. The fat salt pork contains but a small amount of protein (.9 per cent.) and a large proportion of fat, probably 85 per cent.; the bacon contains far more protein and less fat, but the actual percentage composition has not

been experimentally determined. The analysis of bacon by Lethby (8.8 protein and 73.3 fat) refers evidently to dried breakfast bacon; the soldier's bacon contains less meat and more water and is therefore estimated to contain 8 per cent. protein and 69.5 per cent. fat. If fat pork is taken there is a great deficiency of protein and an apparent excess of fats (320 gram.), but the fats are not excessive when it is considered that the active out door life of the camp with its exposures, makes necessary an increased supply of the fats. Indeed, 320 grammes are even below the amounts given by Atwater as consumed by various Massachusetts mechanics. As the bacon contains nearly as much fat as the pork and much more protein it would appear to be a better material for continued use, when fresh meat is not procurable, and it is probably preferred by a majority of officers. If ham or salt beef were used to supply protein, they would not contain enough fat nor relieve the desire for fresh meat. Both of these articles are taken into the field, and the salt beef, though derided during the war as "salt-horse," is even yet considered a desirable article by officers who used it for years. Difficulty of transporting it on rapid marches weighs against it for field use; but for garrison use, an officer of large experience has lately spoken of it in very high terms, as an occasional issue optional with the company commander. In the future it may be entirely supplanted by canned meats, fresh or corned. If the camp is a permanent or large one, the matter of pork and bacon may not arise, for either a beef contractor will be on hand with cattle, or cattle will be purchased by the commissary officers, in accordance with regulations, and driven along with the troops when forage or grazing is procurable. There is an actual craving for fresh meat, and whenever it is possible, it is supplied by purchase; hunting is encouraged whenever practicable, but often fresh

meat is entirely barred out by the barrenness of the country particularly in Indian campaigns. It is this need of fresh meat which induces the foraging expeditions of soldiers in camp—expeditions which often are disastrous to the occupied territory.

#### LIMITATION OF VARIETY OF DIET IN THE FIELD.

In the above field rations, the limitation of variety is due to either difficulty of supply or inefficiency of portable cooking utensils. The nearer the camp is to the markets of civilization, or the more permanent it is, the more nearly will the food approximate to what is used in garrison. There is no theoretical reason why the food in camp should be a particle different from what is used at home, provided there is more of it and there are more fats to supply the extra energy needed for warmth and work. The writer once asked an old packer and teamster accustomed for many years to the life of the wilderness, what kind of foods were best for camp; after considerable thought he answered, "anything good to eat," there was no theory in that answer—it was purely practical experience.

When soldiers are in the field and are limited to the bare ration, and more particularly when lack of transportation limits the ration to bacon, hard tack and coffee, they suffer very badly from constipation. Company commanders who understand this matter, have a simple remedy for their men, in dessicated fruits. These are purchased and carried along, and being light and uninjured by freezing they are always available. There is so much water in fresh fruit, that when dried out, 1 pound of evaporated or dessicated apples at 4 cents will make enough apple sauce for many men, and the expense to the company is trifling. The Canadian mounted police are said to have dried fruit as part of their ration. The commissary officer at Fort Assiniboine, Mont., Lt. J. F.

Morrison, who used dried fruit in the field for his men, is very enthusiastic as to their great excellence in combating constipation. Besides all this, as antiscorbutics, they are of great value should the field service last any length of time, for though scurvy could never occur in garrison, there would be a tendency to it, with the above limited diet.

After hard work when one is depressed and worn out, there is nothing that relieves all ill feelings so soon as a hot drink that is at the same time stimulating. Spirits have been totally discarded with soldiers for this purpose as thoroughly vicious in results. Wines and beer are used in foreign services, but public sentiment will never allow them in the United States. It has been proposed to issue to soldiers in the field, extract of beef, whose stimulating qualities in the form of beef tea are too well known to be enlarged upon here. Now if the extract of beef can be combined with nourishment in the form of soups, a vast deal is to be gained. There can be no doubt that strong soups are highly appreciated in camp, and so experienced an officer as Capt. Spurgin states that it was his custom to make soup for his men, and that he found nothing like it as a hunger killer. Now, if the hunger-killer in the form of soup contains sufficient nutriment for part of a meal, it is a most desirable thing for hungry men who may have to sleep with the heavens for a tent. There is a popular delusion which ascribes to clear soups a much higher nutritive value than they possess. Raw bones contain considerable nutriment, not only fats but protein, and are capable of sustaining life. Though some animals can easily digest raw bones, man cannot; perhaps he could very readily if they were ground to powder. Pavy states that one pound of bones, contains as much carbon as there is in  $\frac{1}{2}$  pound of meat, and as much nitrogen as there is in  $\frac{1}{2}$  pound of meat. All this refers to raw bones, and

in dilating upon the value of bones as a food, writers usually overlook a most important matter. The Paris Gelatine Commission, after ten years of uninterrupted experiments reported that "it is not possible by any known process to extract from bones an aliment which, either alone or mixed with other substances, can take the place of meat," and furthermore they reported that "every kind of preparation, such as decoction with water, the action of hydrochloric acid, and particularly the transformation into gelatine diminishes, and seems even, in certain cases, almost completely to destroy the nutritive quality of bones." After fifty years these conclusions, as far as known, are still accepted. By prolonged boiling of bones, the nitrogenous substances are converted into gelatine, which is dissolved in the water. Gelatine has been denounced as a totally useless agent, but it undoubtedly gives up some energy, though it is extremely doubtful if it is of any further use than as a fuel and a very poor fuel at that. It will not support life. When, therefore, the raw bones of beef are thrown away, the soldier loses very little available nutriment except the marrow, but there is a loss of variety of diet, and it has already been shown that variety though often impossible to obtain should always be sought. Soups add so much to attractiveness if nothing else, that they should be given at least four or five times a week in garrison, and in those companies where the bones are all carefully saved and boiled the men certainly do live better. Though all this is true of clear soups which may not contain much nutriment, it is entirely different with thick soups made from leguminous vegetables, or with other mixtures called soups. Pea and bean soup in particular contain quite a large percentage of the various alimentary principles. The difficulty of preparing the soups in the field is obviated by using one of the prepared articles mentioned more

fully below. There is one in particular, consisting of a mixture of powdered peas, salts, extract of beef, herbs, etc., and sold in packages under the name of "pea-soup." The powder added to a quart of hot water makes in a few minutes a tolerably fair soup, rich, savory and nutritious. The published analysis, the accuracy of which is presumably correct, gives to a  $3\frac{1}{2}$  ounce package the following ingredients:

Protein, 21 grams; fats,  $17\frac{1}{4}$  grams; carbohydrates,  $46\frac{1}{2}$  grams.

Now in the field ration there is a deficiency of nitrogen which can be remedied either by using more bacon or by the use of one of these prepared soups. One of these packages would therefore give a ration with the following values:

	Protein.	Fats.	Carbo-hydrates.	Calories.
Maximum . . . . .	127	387	586	5,614
Minimum . . . . .	85	257	506	5,160
Average . . . . .	106	297	546	5,387

A package of  $2\frac{1}{2}$  ounces contains as much energy as the edible portion of the ration of potatoes (11 ounces) and a proposed package of 4 ounces has the energy of 1.8 rations of potatoes, though it contains far more protein and fat though less carbohydrates than the potatoes of the same amount of energy. It is proposed to use this prepared soup in the field in lieu of fresh vegetables allowed by law.

It may be added that in the field in war times, the transportation is usually insufficient. Officers of this military department know it and the subject receives constant attention throughout the world, for on it depends the success of the campaign. Notwithstanding all that is done, impediments will arise, break-downs occur, and roads become blocked. This always results in deficiency of food, for the rations in enormous quantities may be near by but unattainable, and the troops may be actually incapacitated for good fighting. This state of affairs may occur at

any time and it is usually unavoidable. Again, in forced marches troops may be able to outstrip the wagon trains and then they must carry their own food. Numerous field dietaries containing ordinary articles of diet have been suggested from time to time for those special conditions, but as they have had time to crystalize into some definite shape and have not done so, it is presumed that they are mostly impracticable.

#### PREPARED FOODS.

For the same reasons already mentioned above, condensed and prepared foods have probably occupied the attention of military men from time immemorial; and Parke's Hygiene in speaking of these foods says: "For the military surgeon this subject is so important that it is desirable to put the chief facts under a separate Section." He then gives a list of many preparations of powdered meats, etc., but unfortunately states that many of these were unsatisfactory.

The difficulty in preparing and preserving foods is yearly becoming less and less. It is only within recent years that much attention has been paid to the proper preservation of fresh foods, and we can confidently expect in the future to see much further advance. Specially prepared foods have also attained a high degree of excellence; those intended for infants and invalids receive most attention because most demanded. Of the foods for adults probably the most successful so far are the prepared soups. The German army has had for a long time its Erbswurst, a mixture of pea-meal, fat, bacon, herbs, onions, etc., put up in little sausage-like rolls to be carried by the soldiers. Its present percentage composition is not at hand, but it is said to contain protein, fats, carbohydrates and salts in about the proportions needed in a food. The latest preparations are the pea and

bean soups, made by an English, and several American firms. In each case the material is a powder more or less dry, and in some cases compressed, and when added to hot water makes a good soup, which is quite palatable to the majority of people. Lieut. W. C. Brown, 1st U. S. Cavalry, to whom the writer is indebted for all of the facts relative to the prepared soups, has used them in the field when the weather was very hot, and when a blizzard buried his camp under 12 inches of snow, and he speaks in no uncertain terms of their great value and excellence, and of the ease with which they can be preserved, transported and made ready for use.

There are very numerous prepared foods, either cooked, condensed, or compressed, which are being brought forward for use in such circumstances as surround people in camp. Dried vegetables have been given a trial in the U. S. Navy, and as far as known have not proved objectionable. Almost every variety of food is now being put up in the fresh state and preserved indefinitely, but most of them, particularly the fruits and vegetables are not suitable for military use in the field on account of their bulk, and their inability to stand rough handling, and the extremes of temperature. For garrison use at isolated posts where there is no market there is no reasonable objection to them. The great value of evaporated fruits for field use has already been mentioned, and they can be so compressed by machinery as to obviate objections as to bulk.

The universal experience of military men testifies to the absolute necessity of tea or coffee. The latter is generally preferred, but the writer's experience points to tea as preferable in the long run. Now each is difficult to carry and protect from damage, and the experience of foreign services is to the effect that if they are compressed into small bulk a vast improvement is made as to facility of transpor-

tation and preservation. In our own service during the civil war, extract of coffee combined with milk and sugar was issued in lieu of coffee and sugar, but with what degree of satisfaction the writer is ignorant. At the present time these compressed teas and coffees are quite satisfactory in other services.

A discussion of condensed food among military men brings forcibly to light a false conception which all non-medical men are apt to foster. It is believed that foods can be so extracted and condensed that a teaspoonful will be of the same value as a pound of the crude food. Beef extract is often held up as the ideal concentrated food. It is forgotten that what a man wants is so many ounces of combustible material for its heat energy, and that beyond the concentration due to exclusion of water and indigestible portions nothing further is practicable. Indeed, it is not improbable that a few officers believe that it ought to be practicable to so condense foods that a soldier can carry in his watch fob enough for a week. When a ton of anthracite coal can be compressed into a water bucket, then and then only can foods be condensed to suit such beliefs.

It is well known that on rare occasions the soldier is called upon to perform the most laborious duties, under almost inconceivable exposures and hardships, and it can well be assumed that at such times his food should be liberal to the point of extravagance. But unfortunately it is in just such circumstances that it is impossible to carry along the necessary appliances. It is purely then a matter of transportation, and the most concentrated foods are the only ones carried—bacon,hardtack and coffee—a scorbutic diet. Omitting thoughts of plum pudding and pound cake, he must even be deprived of things that in civilization are considered necessary—a baked potato would be a luxury. These are the circumstances in which the Erbswurst of the Germans and the

dried pea soup of the English have found their greatest efficieney. It is understood that in the wilds of Africa and Asia, the English troops found the latter food of the greatest utility, on account of the impossibility of transporting anything bulky. As lack of transportation bars out potatoes first, it has been suggested by Lieut. W. C. Brown to issue the above pea soup or similar preparation, in lieu of potatoes. This will be done as there is probably ample authority by law, and it can be done without increasing the ration. It is believed that the matter is being giving very earnest consideration in our own army.

#### OBJECTIONS TO PREPARED FOODS.

The one great objection to prepared foods is the ease with which adulterations and other frauds can be perpetrated. Quality of foods can be easily determined if seen in the natural state, but let them be ground up and mixed with other things, and fraud may be difficult or impossible to detect. Good house-keepers will not buy with their eyes shut. The above objection applies far more forcibly to military foods where the consumer is never the purchaser, the cupidity and avariciousness of contractors is greatly stimulated. It is a strange fact that though contractors know that at times the lives of the soldiers and the safety of the nation may depend on the character of the army supplies, they will yet jeopardize the lives of thousands of men by fraudulently supplying inferior articles. The disasters and sufferings during the Crimean war were increased to a great extent by the poor grade of supplies. The military history of the United States furnishes a host of illustrations of operations and even campaigns being hampered or even made disastrous by faulty food. The German government escaped this dilemma by making its own Erbswurst, and if any government

makes its soldiers' arms, ammunition, clothing and shelter, it can surely make his food. The objection is lessened when it is remembered that prepared foods are not intended as a sole diet, but merely to piece out the notoriously rough field diet, and the objection may entirely disappear by an efficient system of analysis and inspection. Above all this it may be argued that if easily transported prepared, cooked foods are to be a valuable innovation, it might be justifiable to run the risk of being occasionally furnished with inferior grades, a risk that we run in the majority of mercantile transactions.

During the civil war, it is stated that roasted and ground coffee was greatly objected to on account of adulteration, but it has also been stated that the adulteration was done openly, ground and roasted rye being purchased for the purpose. In regard to adulterated coffee the writer has seen somewhere a statement that the average soldier prefers coffee that is adulterated with chicory.

Another objection to concentrated foods as a sole and continuous diet is the fact that they do not furnish enough bulk of food. Though they may contain the proper amounts of energy and alimentary principles they can never be used exclusively. But they are not intended to be so used except in emergencies and for short periods.

#### TRAVEL RATION.

When cooking is impracticable on account of traveling by cars, or rapid marches or for other reasons, a special cooked ration is issued. The items of this ration are stated in table 9.

This ration is insufficient for active men, being equivalent to the food of men of sedentary habits. The protein is the only ingredient in nearly the proper amount, and this arises from the meats and beans. As this ration is intended for short periods

TABLE IX.—TRAVEL RATION.

Meat . . . . .	12 oz. canned beef, fresh or corned.	Total weight, 2 to 2½ Ibs.
Bread . . . . .	{ 18 oz. soft bread or 16 oz. hard bread . . . . .	
Vegetables . . . . .	½ to ½ lb. baked beans.	

Coffee . . . . . 21 cents a day for the purchase of liquid coffee en route.

The above has the following composition (approximately):

Grams . . . . .	Maximum . . . . .	Minimum . . . . .	Carbo-hydrates.		
			Protein.	Fats.	Calories.
Mean . . . . .			135	132	3,400

of inactivity (on cars, etc.) it might be said that the insufficiency is more apparent than real, but as men traveling usually develop enormous appetites they may need more than when in garrison. Nevertheless, it might be improved by the addition of prepared soups as in the case of the field ration.

A further defect of this ration is the inability of a man to carry enough for several days should military necessity compel him to be detached from the main command, carrying dispatches, scouting, etc. On such occasions he must learn to do as the Indian does,—twice a day take a drink of water and tighten his belt.

#### COMMUTATION OF RATION.

When small parties of soldiers are detached and it is impracticable to furnish them either cooked or uncooked rations and they are so situated that they can buy their meals, they are paid a certain sum in lieu of food. The ration cost about 14 or 15 cents (approximately) but when the soldier is on leave he is allowed 25 cents a day, when on detached duty 30 cents (non-commissioned officer 40 cents) and when traveling \$1.50 a day.

TABLE X.—COMPARISON OF FOODS OF SOLDIER WITH VARIOUS OTHER DIETARIES.

	Grams.				Grains.	
	Protein.	Fats.	Carbo-hydrates.	Calories.	Nitrogen.	Carbon.
German soldier (peace footing) . . . . .	114	39	480	2800	277.4443	
Fully fed tailors, England . . . . .	131	39	525	3055	318.4862	
Travel ration, U. S. . . . .	135	132	400	3400	328.5194	
Machinist (Connecticut) . . . . .	105	147	399	3435	255.5145	
Factory operatives (Massachusetts) . . . . .	114	150	522	4000	277.6048	
Factory operatives (French Canadians) Mass. . . . .	118	204	549	4630	287.6901	
German ration, war (extraordinary) . . . . .	157	285	331	4650	382.6750	
U. S. garrison ration (including canteen) . . . . .	152	180	570	4621	370.6805	
Same (including beer) . . . . .	155	180	633	4907	377.7446	
U. S. field ration (average) . . . . .	155	280	500	5000	296.7247	
Machinist (Massachusetts) . . . . .	182	254	617	5640	442.8423	
Teamsters, hard work, Massachusetts . . . . .	254	363	826	7805	617.9950	

The U. S. rations would be slightly increased by including the amounts of nutriment in the articles of table 5.

Table 10 is prepared to show at a glance how the various rations discussed compare with the food of civilians. They are tabulated with various dietaries that have been published by Atwater. It is thus shown, that as far as the total energy is concerned the various rations compare rather favorably with the dietaries of various laborers in the United States. Only one dietary of foreign laborers is given for they are all less than those of American laborers of the same grade—the foreign workman, according to Atwater, being as much underfed as some American workmen are overfed. The field ration would be reduced in carbohydrates if potatoes could not be carried. Taking the largest dietary on the list as unity,—that is, the food of teamsters in Massachusetts doing hard work,—the energy of the various rations would be as follows: Field ration  $\frac{9}{5}$ ; garrison ration,  $\frac{9}{5}$ ; travel ration  $\frac{7}{5}$ .

The rations of foreign armies approximate to the usual food of the people, which as we have just seen is less than that of Americans; for this reason it is unfair to compare the U. S. ration with that of foreign armies, unfair to the former, which by the contrast appears more liberal than it is, unfair to the latter which similarly is apparently illiberal or actually deficient.

TABLE XI.—ESTIMATED PROPORTIONS OF ORDINARY DIETARIES.

	Protein.	Fat.	Carbo-hydrates.	Salts.
Playfair (moderate exercise and soldiers in peace) . . .	100	33	443	17
Moleschott . . . . .	100	65	315	23
Pettenkofer & Voit . . . . .	100	87	258	22
U. S. travel ration . . . . .	100	98	296	24
Ranke . . . . .	100	100	240	25
U. S. garrison ration . . . . .	100	117	400	24
U. S. field ration . . . . .	100	329	588	24

The larger percentage of fats over protein in the U. S. rations in table 11 corresponds to the increased proportion of fats over protein found in all American dietaries according to Atwater, a still further evidence of the unfairness of comparing the U. S. ration with that of foreign soldiers.

#### SPECIMEN DIETARIES.

There are given in tables 12 and 13, a week's bill of fare taken at random and furnished by two company commanders, one at Fort Assinniboine, Montana, and the other at a hot southern post. These two are in the strongest contrast, the first so liberal, and the latter so bare, that they exemplify in the most fortunate way some of the remarks previously made as to the conditions of service varying the bill of fare. The company at Fort Assiniboine possessed

an excellent cook and a large company fund, received nearly \$50 a month from the Post Exchange, at the time chosen had vegetables from a fairly good garden, and could purchase extras fairly reasonably from neighboring towns and even St. Paul, but none of the conditions were as good as at other posts with excellent gardens, large receipts from the Exchange and convenient to good markets. The other company had no fund, no receipts from Post Exchange, no garden, no markets even if they had money to buy, and the result shows what the ration itself can do, supplemented as it was by  $\frac{2}{3}$  to 1 pound potatoes daily per man purchased from meagre savings. Its commander also states as one reason for small "savings" that many of the soldiers are not much more than boys, and that they discover eating abilities surpassed by none except Indians. He is thoroughly alive to the interests of his men and gives much thought to the ration, and when favorably situated the company fared excellently. The bill of fare can therefore be correctly assumed to be the best that could have been done.

TABLE XII.

A company's dietary at Fort Assinniboine, Montana (Capt. Alfred Reynolds' Company).

*December 1, 1891.*

(Gravy always served with meats, and sauce with puddings.)

Breakfast: Beef stew, fried potatoes, corn bread, syrup, bread, butter, coffee.

Dinner: Meat pie, mash potatoes, turnips, cabbage, pickled pork, bread, coffee.

Supper: Beefsteak with onions, squash pie, bread and coffee.

*December 2, 1891.*

Breakfast: Roast beef, fried potatoes, bread, butter, coffee.

Dinner: Pea soup, roast beef, baked potatoes, stewed onions, cauliflower, tapioca pudding, bread and coffee.

Supper: Meat stew, fried carrots, apple pie, bread, coffee.

*December 3, 1891.*

Breakfast: Oatmeal, milk, meat hash, bread, coffee.  
 Dinner: Sauerkraut, pickled pork, mashed potatoes, pickled beets, rice pudding, bread and coffee.  
 Supper: Fried sausage meat, fried potatoes, green corn, blanc mange pudding, bread and coffee.

*December 4, 1891.*

Breakfast: Beefsteak with onions, fried potatoes, bread, coffee.  
 Dinner: Roast beef, mashed potatoes, stewed onions, pickled beets, plum pudding, bread, coffee.  
 Supper: Fried liver and bacon, fried carrots, squash pie, bread, coffee.

*December 5, 1891.*

Breakfast: Beefsteak, fried potatoes, bread, butter, coffee.  
 Dinner: Pork and beans, peach pie, bread, coffee.  
 Supper: Cold beef, corn bread, syrup, apple sauce, bread, coffee.

*December 6, 1891.*

Breakfast: Meat hash, oatmeal, milk, bread, butter, coffee.  
 Dinner: Vegetable soup, mashed potatoes, roast beef, pickles, tapioca pudding, bread, coffee.  
 Supper: Beef stew, green apple pie, bread, butter, coffee.

*December 7, 1891.*

Breakfast: Roast beef, baked potatoes, hot rolls, syrup, bread, butter, coffee.  
 Dinner: Sauerkraut, pickled pork, mashed potatoes, roast beef, bread, coffee.  
 Supper: Meat pie, rice pudding, bread, butter, coffee.

*December 25, 1891, Christmas.*

Breakfast: Meat hash, oatmeal, milk, hot rolls, bread, butter, coffee.  
 Dinner: Roast turkey, roast beef, green corn, French peas, ham, mashed potatoes, pickles, cranberry sauce, mince pie, jelly cake, sponge cake, bread, butter, coffee, almonds and filberts.  
 Supper: Oysters, cold ham, cold beef, apple sauce, assorted cakes, green apple pie, bread, butter, tea.

#### TABLE XIII.

A company dietary at a hot southern post.  
 (Gravy always served with meats, and sauce with puddings.)

*April 1, 1892.*

Breakfast: Beef hash, (with onions and potatoes) bread, coffee.

Dinner: Rice and tomato soup, roast beef, roasted potatoes, bread.

Supper: Beef, (same as dinner) bread, coffee.

*April 2, 1892.*

Breakfast: Irish stew, bread, coffee.

Dinner: Pea soup (with toasted bread), roast beef, boiled potatoes, bread.

Supper: Beef, pancakes, syrup, bread, coffee.

*April 3, 1892.*

Breakfast: Meat hash (with potatoes and onions) bread and coffee.

Dinner: Roast beef, mashed potatoes, plum pudding, bread and coffee.

Supper: Fried liver and bacon, bread and coffee.

*April 4, 1892.*

Breakfast: Beef hash, bread and coffee.

Dinner: Baked fresh pork, baked beans, bread and coffee.

Supper: Beefsteak, fried potatoes, bread and coffee.

*April 5, 1892.*

Breakfast: Irish stew, bread and coffee.

Dinner: Rice and tomato soup, roast beef, boiled potatoes, bread.

Supper: Beef, fried potatoes, bread and coffee.

*April 6, 1892.*

Breakfast: Beef hash, bread and coffee.

Dinner: Rice and tomato soup, roast beef, boiled potatoes, spiced bread dressing, bread.

Supper: Meat pot-pie, bread and coffee.

*April 7, 1892.*

Breakfast: Fried pork, fried potatoes, bread and coffee.

Dinner: Pea soup, with toasted bread, roast beef, boiled potatoes, bread.

Supper: Beef, fried potatoes, bread, coffee.

In view of the above bills of fare, and of all that has been said about the ration, it must be stated that it is a notorious fact that when sensational complaints from soldiers are published in the newspapers, it too often happens that when sifted down,

they are shown to come from men who are inclined to be vicious, and who before enlistment have been accustomed to far worse fare, but who think that to complain is sure evidence of personal superiority. These cases are apt to dampen the ardor of officers, who with rare exceptions, are thoroughly interested in the soldier's welfare.

For the major part of the data of this paper the writer is indebted to the courtesy of the officers serving at Fort Assinniboine, Montana, who have with painstaking care weighed and determined the foods used in their respective companies and supplied all data at their command.

#### ERBSWURST.

Of the legion of prepared foods that have been used for military purposes the only ones that have given much satisfaction, and to which there are few objections, are those made with powdered peas as a basis. In some armies these are now always sent into the field with troops to be used when other foods cannot be supplied. As Erbswurst is the pioneer of this class, and has been frequently referred to, a few words as to what it is may not be out of place, though they may repeat former reports to this Section. Captain Henry G. Sharpe, C. S., U. S. Army, who has devoted much time and study to this subject both at home and abroad, has very kindly furnished the following information from his reports.

"Erbswurst is a combination of pea meal and other articles, invented by a German cook named Grünberg, whose secret consisted in his method of preserving the legumine from the decay to which it is so prone. The German Government purchased the secret for \$25,000. It was first used on a large scale in the Franco-Prussian war by the II army commanded by Prince Frederic Charles, who reported its great value to the war ministry July 16, 1870. The food

was composed of pea meal, fat and bacon, and an extensive factory for making it was established at Berlin, under the supervision of Army Intendant Englehard. The factory commenced work on August 8 and in a few days furnished the first 100,000 pea sausages which under the name of "Erbswurst" became so widely known. This article of food met with such general approval that for a long time the factory had to supply the whole army with it. The factory ultimately extended its business to making other kinds of meat preserves and altogether sent some 40,000,000 rations to the field army. Other factories were established at Frankfort-on-the-Main, and Mainz.

This description of food had the advantage for the commissariat in being lighter for transport, and for the troops, especially for those on outpost duty, in being more easily prepared for consumption. The unavoidable sameness of the ration, was successfully compensated for by the large stores of wine found in the neighborhood of Paris, and by the occasional issue of an extra ration of brandy."

Parke's Hygiene states that when it was used too constantly not only did the men dislike it but it was liable to produce flatulence and diarrhoea. A soldier who has lately returned from a visit to Germany informs the writer that the soldiers in private conversation still speak of it in the highest terms. On account of certain seasoning ingredients in Erbswurst the English soldiers do not like it, though they are very fond of their similar preparation of pea soup.

In table 14 are arranged some analyses of these pea-meal mixed foods. The English pea-soup appears to be drier than the others, and as the actual analysis above shows it to be so, it will probably keep better than the others. The percentage of fat though not great enough for American stomachs is far more

TABLE XIV.—COMPOSITION OF SOME PREPARED MILITARY FOODS.

	Water.	Protein.	Fat.	Carbo-hydrates.	Wood-fiber.	Ash.	Authority.
Erbswurst . . . . .	12.09	31.18	3.08	47.50	. .	6.15	Blythe.
" as first used . . .	. .	16.00	35.00	27.00	. .	. .	Parkes.
" 1887 . . . . .	. .	15.70	23.00	. .	. .	. .	"
Dried pea soup (1) . . . . .	7.58	16.93	8.98	53.44	1.34	11.73	Konig.
" " (2) . . . . .	8.08	15.81	24.41	36.78	1.69	13.53	"
Kopf's " " (used by the English army.)	4.78	21.09	17.25	46.45	4.40	6.03	S. P. Sharpless (Boston).

than the first specimen of Erbswurst. If it were more fatty it would not keep as well as it does. Several American firms make dried pea soups and it is regretted that analyses of their products are not available for comparison.





